
PUBLIC HOUSING AND CRIME IN SYDNEY

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PREFACE

Following a series of disturbances on a public housing estate in Villawood, New South Wales (NSW), in December 1995, there was considerable speculation about the role which public housing estate design plays in influencing crime. Such speculation was encouraged by the fact that crime problems have, from time to time, flared up on other public housing estates in NSW. It was also encouraged by the fact that Villawood housing estate conforms to what is known as a Radburn design. This design features dwellings facing each other around an open (usually grassy) space. Vehicles are confined to the back of the dwellings, which are linked to each other by pedestrian walkways and paths. It has been suggested that such a design causes crime problems because it creates opportunities for crime not present in more conventional housing estate designs.

Villawood, however, in common with most other suburbs containing significant numbers of public dwellings, contains many characteristics which would increase its susceptibility to crime, regardless of the design of those dwellings. It has been known for some time, for example, that young unemployed persons are both more at risk of involvement in crime and more at risk of becoming crime victims. Public housing estates tend to have higher proportions of such people for the simple reason that public housing is (quite properly) targeted at those who are most in need. It is possible, then, that the crime problems encountered on public housing estates such as that in Villawood have less to do with their design than with the socioeconomic profile of persons who reside on them. The present research was commissioned by the NSW Department of Housing in a bid to address this issue.

The study results do not disprove the hypothesis that public housing estate design influences crime. But they do show that neither the percentage of public renters nor the level of dispersal of public housing or the type of housing found in a postcode exerts much effect on its crime rate when social and economic factors have been taken into account. This may be read by some as suggesting that crime problems on public housing estates can be blamed on the criminal activities of public renters. It is important to emphasise, therefore, that no such conclusion can be drawn from this study. It simply shows that, once variations in the social and economic profile of postcodes across metropolitan Sydney have been taken into account, public housing variables are of little use in explaining variations in crime.

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EXECUTIVE SUMMARY

Following media attention on issues relating to public housing and crime in Sydney, the NSW Bureau of Crime Statistics and Research was funded by the Department of Housing to conduct research on the relationship between the two. Previous research suggests that areas displaying high crime rates also display high levels of social disadvantage, and that, increasingly, public housing has been targeted towards those in greatest need - that is, the most disadvantaged. In the light of these associations, it is important to take social factors into account when assessing any relationships between public housing and crime.

The present study looked at the effects on crime rates of certain features of public housing in Sydney postcode areas, namely the proportion of public renters, the proportion of public housing dwellings, the degree of dispersal of public housing and the type of public housing, while controlling for the effects of social factors such as unemployment, income, family structure, residential stability, age and Aboriginality. The offences examined were assault, robbery, malicious damage to property, motor vehicle theft and break and enter dwelling. Information on these offences was based on criminal incidents recorded by the NSW Police Service.

The study results show that between 48 per cent (malicious damage) and 69 per cent (assault) of the variation in recorded crime rates across postcodes can be accounted for by social factors alone. Once social factors have been controlled for, the effects of public housing dwellings and public housing renters, while statistically significant, are generally small, accounting for, at most, an additional three per cent of the variation in recorded crime.

Whether public housing is dispersed or concentrated into estates also appears to make little difference to the variation in recorded crime rates, while the proportion of different types of public housing dwellings exerts some statistically significant but very small effects on some of the offence types examined.

The report concludes that the statistical association between public housing and recorded crime is largely, if not entirely, a consequence of the fact that public renters are more likely to be crime victims or offenders rather than a consequence of the physical design or planning of public housing.

1. INTRODUCTION

In early 1996, the NSW Department of Housing (DOH) asked the NSW Bureau of Crime Statistics and Research to examine the question of whether there was any relationship between public housing and crime. This request was prompted in part by a series of disturbances on a public housing estate in Villawood in December 1995 which focused media attention on the issue of public housing and crime. The trouble at Villawood was, however, by no means the starting point for DOH concern. Considerable attention had already been paid to issues of resident safety and amenity in areas of public housing,¹ and substantial funding had been allocated for alterations to some major estates in a bid to improve security and resident satisfaction.² In the light of these factors it was considered important to examine the overall picture of crime and public housing in a systematic fashion.

There is a large body of theory and research describing the effects of differing residential environments on the opportunities for crime. From the 1970s onwards, in the United States and Britain particularly, housing design has been the focus of much debate. Newman (1972) drew attention to the relationship between crime and the design features of housing in his influential work on 'defensible space'. Newman found that high-rise housing estates had higher crime rates than low-rise ones. From a detailed analysis of architectural and planning features he concluded that building scale and design played a key part in facilitating the informal surveillance carried out by residents. Furthermore, ambiguity in the definition of public and private spaces in large scale developments meant that criminal intruders were more likely to go unchallenged.

Following on from Newman's work, numerous studies have developed strategies for 'environmental crime prevention'. Poyner (1983), for example, has advanced a set of recommendations ranging from planning of residential areas to elements in building design. Factors commonly associated with crime reduction include the clear definition of public and private areas, the ease of surveillance of dwellings from the street and the street from dwellings, and the separation of residential neighbourhoods from commercial areas and arterial routes. In the Australian context, these principles have been articulated by researchers such as Sarkissian (1984) and Geason and Wilson (1989).

Public housing estates have offered a particular focus for research on environmental crime prevention. Being designed and developed in bulk, they are often the most undiluted expression of the architectural and planning theories of the day. Public tenants reap the consequences of the most innovative and sometimes, unfortunately, the most disastrous of developments. While Sydney has few of the high-rise estates often seen as the focus of problems overseas, there is still a pervasive feeling that some public housing designs are problematic. One example concerns estates built following the 'Radburn' plan from the United States.³ These estates were designed to separate cars from pedestrians. They feature service roads to accommodate garages at the back, while the front of the houses are linked by pedestrian paths across grassy open space. This type of design was thought to encourage neighbourly interaction, and allow for greater safety of children playing in communal areas. However, these estates, regarded as innovative when built, are now often seen as prime offenders in environmental crime prevention terms. Open space, rather than being 'communal' is said to become a threatening 'no-

man's land'. Residents cannot effectively 'police' their territory because its limits are not clearly marked, while rear access to cars and garages, hidden behind high fences, makes informal surveillance very difficult. In addition such estates are recognisably different from surrounding neighbourhoods, making them easy targets for community criticism and stigmatisation of residents.

Debate continues, however, over whether crime problems in residential areas can be explained and controlled largely by physical design and planning, or whether social and economic factors are the more important. Over the last 15 to 20 years public housing has increasingly been targeted towards those of greatest disadvantage, a group known to have high risks of both involvement in and vulnerability to crime. The DOH notes that in the 1960s and 1970s, when much of its housing stock was constructed, the social profile of public estates did not differ significantly from other low to middle income areas. Now, in contrast, some 95 per cent of public tenants depend on social benefits of some kind for their income (NSW Department of Housing 1996b, p. 5). Further evidence of the growth of urban poverty in Australia is offered by Gregory and Hunter (1995) who have studied changes over the last 20 years. Their work demonstrates that the gap between the poorest and richest urban areas has increased markedly over that period and they comment on the emergence of geographically distinct 'ghettos' characterised by low socio-economic status.

Both in Australia and overseas, disadvantaged urban areas have been found to be more crime-prone. Chiricos (1987) examined 63 studies of the relationship between unemployment and crime from the United States and Canada. He found that 93 per cent of the comparisons which examined city-wide data showed a positive link between property crime and unemployment, while for violent crime 100 per cent of the city-based comparisons were positive. Furthermore, he found that studies based on data from the 1970s, when unemployment was rising to its highest levels since the 1930s, were more likely than earlier studies to show a positive relationship between crime and unemployment. In Europe, McClintock and Wikström (cited in Bell Planning Associates and Gaston 1995) compared crime statistics in Stockholm and Edinburgh and concluded that, in both cities, low socio-economic status and social instability significantly predicted rates of violent offences. In Australia, Devery (1991) examined proven offender rates for violent and property crime in Local Government Areas (LGAs) across NSW. He found that LGAs in Sydney with high rates of resident proven offenders also tended to have high percentages of poor families, single-parent families and high levels of unemployment.

Considering the changing social profile of public tenants in conjunction with the research on disadvantage and crime, therefore, it is quite possible that any link between public housing and crime may simply be a consequence of an increasing concentration of disadvantage.

The question of whether or not public housing influences crime rates is an important one. In NSW, there are over 132,000 dwellings rented from the DOH (NSW Department of Housing 1995, p. 10), representing around 6 per cent of all occupied private dwellings. The State spends around 1,100 million dollars providing public housing and a further 1,000 million dollars controlling crime annually.⁴ Consequently, the possibility that public housing does influence crime has important implications for public housing and crime prevention policy. In the light of the debate on this issue, the DOH asked the NSW Bureau of Crime Statistics and Research to examine five questions. These were:

1. Is there a relationship between the percentage of public renters in a postcode and its crime rate, controlling for other factors which may influence variation in crime rates across postcodes?
2. Is there a relationship between the percentage of public housing in a postcode and its crime rate, controlling for other factors which may influence variation in crime rates across postcodes?
3. If either (1) or (2) are answered in the affirmative, is there any evidence of a threshold effect (i.e. at what level of the relevant public housing factor, if any, is there a sharp increase/decrease in crime rates)?
4. Is there a relationship between the degree of dispersal of public housing in a postcode and its crime rate, controlling for other factors which may influence variation in crime rates across postcodes?
5. Is there a relationship between the type of public housing in a postcode and its crime rate, controlling for other factors which may influence variation in crime rates across postcodes?

Questions 1 and 2 are very similar, but it was considered that there might be some systematic difference in the number of residents per dwelling in public housing compared with other housing which might mean that dealing only with dwellings or residents would not provide a full picture. Question 4 is designed to tackle the issue of whether the effect of public housing (if such an effect exists) is related not just to the proportion of public housing dwellings in an area but to whether they are grouped together in estates or are mixed fairly evenly with the non-public housing. Question 5 is intended to examine the relationship (if any) between crime rates and different forms of dwellings – from high-rise flats, through small blocks (so-called ‘walk-up’ style flats of two and three storeys), terrace, semi-detached and town-house style dwellings, to detached houses on their own blocks of land. This report describes the research conducted to address these five questions.

2. METHOD

The method section is organised into three parts. Section 2.1 provides an outline of the statistical method used to conduct the analysis. Section 2.2 describes the data sources and definitions. Finally, Section 2.3 lists the social factors which compose the statistical model for each of the five criminal offences examined.

2.1 DATA ANALYSIS METHODOLOGY

It is obvious that crime rates will vary from one area to another, whether the area be a city, a suburb, a local government area or a postcode. Some of the variation in crime rates will be due to chance fluctuations, but most will be due to differences between the areas themselves. Areas will clearly differ from one another, for example, in their social and demographic profiles. Those characteristics of an area which vary as crime rates vary are said to be 'associated' with crime rates. For example, if areas with high levels of unemployment tend to have high crime rates and areas with low levels of unemployment tend to have low crime rates, then unemployment is associated with crime. The degree of association between two factors (such as unemployment and crime rates) can be measured by their correlation.⁵ The correlation between crime rates and unemployment, for example, measures the extent to which variations in unemployment 'explain' variations in crime rates. It is important to note, however, that factors which are known to correlate with crime are not necessarily the causes of crime. There may be other underlying factors operating which are associated both with the known factors and with crime.

As noted in the Introduction, crime rates tend to be higher in disadvantaged areas, and public housing is targeted at those who are disadvantaged. The net result of this is that a statistical relationship between public housing and crime will emerge simply because of the association between disadvantage and crime. In order to determine whether public housing is associated with crime in its own right it is necessary to control for the social and economic factors which reflect 'disadvantage' and which are known to be correlated with crime.

When two factors are correlated with each other, levels of one factor (the 'dependent' factor) can be 'predicted' from the other. A high correlation implies that more of the variation in the dependent factor can be explained and hence that it can be predicted more accurately. The same principle may also be used to predict the dependent factor from a combination of several factors which correlate with it.

To test the hypothesis that public housing has a separate effect on crime rates, the first step is to develop a statistical model using a combination of social factors to predict crime rates.⁶ Once this base model is established, the public housing factor can be added to the set of social factors to create a new, inclusive, model. The result from the base model, with the social factors alone, is compared with that for the inclusive model to see whether more of the variation in the crime rates has been explained.⁷ A statistically significant difference between the two will indicate that the public housing factor is associated with the crime rate independently of the influence of the social factors.⁸

2.2 DEFINITIONS AND DATA SOURCES

The study was limited to the Sydney metropolitan area, since it is here that the majority of perceived problems relating to public housing and crime are concentrated. The unit of analysis chosen is the postcode, this being the smallest area for which recorded crime figures are available. The definition of Sydney is based upon the postcodes which make up the Sydney Statistical Division as defined by the Australian Bureau of Statistics (ABS), but since data obtained from the DOH did not include the Central Coast, these postcodes were excluded.

A number of postcodes were excluded from the sample either because they are anomalous or because they have small populations. These postcodes are:

- University of Sydney (2006)
- Balmoral Naval PO (2091)
- Macquarie University (2109)
- Flemington Markets (2129)
- Concord Repatriation Hospital (2139)
- Ingleburn Military PO (2174)
- Richmond RAAF (2755)
- Quakers Hill RAN (2764)

Three additional postcodes were excluded because they were created after the date of the 1991 Census which provides the socio-economic data. These are Silverwater (2128), Oyster Bay (2225) and Parklea (2768). The final set of postcodes numbers 234.

2.2.1 Crime rates

The offences chosen as most pertinent to this study are assault, malicious damage to property, motor vehicle theft, break and enter dwelling, and robbery. Crime data for NSW are collated by the NSW Bureau of Crime Statistics and Research quarterly and are based on criminal incidents recorded by police on their Computerised Operational Policing System (COPS). COPS was implemented in April 1994 and recording of criminal incidents in COPS differs from the system previously used. For this study all the data from April 1994 to the end of 1995 (the most recent data available) have been aggregated in order to present the fullest possible picture of the offences. To control for variations in population size across postcodes, the offences are analysed in terms of rates per 100,000 head of population rather than raw numbers of incidents.⁹ Each offence is thus represented as a rate per 100,000 residents for each postcode.

2.2.2 Social correlates of crime

When it comes to selecting social factors to include in the model, criminological research suggests numerous possibilities.

Previous work by the NSW Bureau of Crime Statistics and Research (Devery 1991) has established that there are significant correlations across geographical areas between the locality of residence for property and violent offenders and a number of social characteristics of the population in those areas. Key among these were the percentages of low income earners, unemployed, single-parent families and Aborigines. Of these,

the percentages of poor families and unemployed persons can be seen as direct measures of socio-economic disadvantage, while factors such as the percentages of single-parent families and Aborigines are linked with disadvantage because these groups tend to suffer poor economic conditions. These factors have all, therefore, been considered in the current analysis. A further factor which may be seen, along with unemployment, as indicating potential economic disadvantage has been added to these, namely, lack of formal qualifications.

Bell Planning Associates and Gaston (1995, p. 42), in their review of relevant research, summarise a number of factors which influence the variation in levels of personal and property crime across areas. These include degree of urbanisation, degree of resident stability or mobility and variations in youth population. Crime rates tend to be higher in older areas closer to the centre of the city,¹⁰ and in these areas dwellings tend to be of a denser, non-detached type. One way of operationally defining 'degree of urbanisation', therefore, is to look at the proportion of non-detached dwellings in each postcode. Similarly, the degree of residential stability can be defined as the proportion of residents remaining at the same address over a period of time, for example, for the five years from one census to the next.

Research on social factors and crime frequently examines the role of juveniles. Wilson (1979), for example, in her study of vandalism on London housing estates found that child density and numbers of children were crucial factors in explaining vandalism levels. The proportion of juveniles has thus also been included in the list of social factors for the present study.

Information on these factors is available from the 1991 Census through the ABS.¹¹ A ready-made set of tables of social statistics, based on the census, called the Basic Community Profile, provides information on the resident population by postcode.

The full set of operationally defined social factors to be included as potential control factors is listed below. As postcodes differ in population size, each factor is calculated as a percentage of the appropriate population.

- **Aboriginality:** persons of Aboriginal or Torres Strait Islander background as a percentage of all persons.
- **Dwelling density:** all occupied private dwellings which are not detached houses as a percentage of all occupied private dwellings.
- **Juveniles:** those aged 10 to 19 as a percentage of all persons.
- **Low income:** households with (gross) income of \$25,000 or less as a percentage of all households.
- **Non-qualification:** persons aged 15 or more, with no qualifications beyond secondary school and not currently engaged in training, as a percentage of all persons aged 15 or more.
- **Single-parent families:** all single-parent families with or without dependent offspring as a percentage of all families.
- **Stability:** persons aged 5 or more living at the same address 5 years ago as a percentage of all persons aged 5 or more at home on census night.
- **Unemployment:** unemployed persons aged 15 or more as a percentage of all persons aged 15 or more (i.e. all persons considered to be potential full-time workers).

- **Young adult unemployment:** unemployed persons aged 20 to 24 as a percentage of all persons aged 15 or more (this group was found to correlate more highly with crime rates than a group which covered unemployed 15 to 24 year olds).

From the above set only those factors which correlate significantly with the offence rate in question have been included in the base model for that offence rate. Note that unemployment is represented by two alternatives, one describing general unemployment, and one specifying unemployment among young adults. Both of these correlate significantly with all of the five offences. In each case, the unemployment factor which correlates more highly with the offence is the one chosen to be included in the model for that offence.

2.2.3 Public housing factors

These are the factors specified in Questions 1, 2, 4 and 5 of the research brief. They are defined as follows:

Public renters: This is defined as people living in dwellings rented from the DOH as a percentage of all persons living in private dwellings. (Source: 1991 Census.)

Public housing: This is defined as occupied private dwellings rented from the DOH as a percentage of all occupied private dwellings. (Source: 1991 Census.)

Estate (degree of dispersal): For this factor a list of 'estates' (i.e. non-dispersed public housing) was obtained from the DOH. The DOH define an estate as 'an area of a size, concentration and/or design which identifies it as a distinctly public housing neighbourhood'.¹² On the basis of this list each postcode is allocated to one of two categories, 'estate' or 'non-estate', depending on the presence or absence in the postcode of one or more 'estates' as defined.

Type: Data on dwelling type were provided by the DOH. The 13 categories of dwelling classified by them have been reduced to four which broadly reflect different densities of dwelling. The number of dwellings in each category has been converted to a percentage of the total number of public housing dwellings in each postcode. The resulting four factors are defined as follows:

- **High-rise:** dwellings in high-rise blocks of flats as a percentage of all DOH dwellings.
- **Walk-up:** dwellings in multi-unit walk-up blocks, together with maisonettes and 'Turner Rigby' style developments as a percentage of all DOH dwellings.¹³
- **Non-detached:** all terrace ('row'), semi-detached, town-house, duplex, triplex and cluster type dwellings as a percentage of all DOH dwellings.
- **Detached:** Free-standing dwellings on separate blocks of land as a percentage of all DOH dwellings.

2.3 CHOICE OF SOCIAL FACTORS FOR EACH MODEL

As described in Section 2.1, for each of the Questions 1, 2, 4 and 5¹⁴ a pair of statistical models is developed for each type of offence being studied. Since there are five different

offences to be examined, this method generates five pairs of models for each of the questions, a total of twenty comparisons. Not surprisingly, the relationship between social factors and crime varies according to the nature of the offence being considered.

The combination of social factors to be included in the model for each offence rate was determined by examining the pairwise correlations of the social factors with the offence rate. These correlations are shown in Appendix 2. (For information, Appendix 2 also shows the correlations between the social factors and the public housing factors.) Of the social factors listed in Section 2.2.2, low income, juveniles, single-parent families, stability, dwelling density, unemployment and young adult unemployment are significantly correlated with all five offences. In some cases (motor vehicle theft and robbery) young adult unemployment is correlated more highly than unemployment, and so this measure is substituted for unemployment in the models for these factors. Aboriginality is not correlated significantly with robbery and so is not included in the models for this offence. Finally, non-qualification is only significantly correlated with assault, and so is only included in the assault models.

The full list of social factors included in the models for each of the five offences is as follows:¹⁵

Assault:

- Low income
- Unemployment
- Juveniles
- Single-parent families
- Stability
- Aboriginality
- Dwelling density
- Non-qualification

Break and enter dwelling:

- Low income
- Unemployment
- Juveniles
- Single-parent families
- Stability
- Aboriginality
- Dwelling density

Malicious damage:

- Low income
- Unemployment
- Juveniles
- Single-parent families
- Stability
- Aboriginality
- Dwelling density

Motor vehicle theft:

Low income
Young adult unemployment
Juveniles
Single-parent families
Stability
Aboriginality
Dwelling density

Robbery:

Low income
Young adult unemployment
Juveniles
Single-parent families
Stability
Dwelling density

3. RESULTS

This part of the report is organised into six sections. Section 3.1 provides an overview of the distribution and types of public housing in Sydney, while Section 3.2 presents the correlations between the crime rates for the five types of offence and the main public housing factors: public renters and public housing. The results of the statistical analyses are presented in Sections 3.3 to 3.6. Section 3.3 covers Question 1, the effect of public renters. Section 3.4 covers Question 2, the effect of public housing, and Question 3, the issue of threshold effects. Section 3.5 deals with Question 4, on public housing dispersal, while Section 3.6 addresses Question 5, the effect of public housing type.

3.1 THE DISTRIBUTION OF PUBLIC HOUSING IN SYDNEY

Interpretation of the study results will be assisted by an understanding of the distribution and nature of public housing in Sydney at the postcode level. The following summary is based on data from the 1991 Census. Across the 234 postcodes in the study, the total number of occupied private dwellings per postcode ranges from 83 (Menangle Park) to 20,610 (Liverpool). The average number of dwellings is 4,843.1 and the standard deviation is 3,593.6. Two hundred and eighteen (93%) of the postcodes have less than 10,000 dwellings, and 13 (6%) have less than 500 dwellings.

Figure 1 shows the percentage of public housing in each postcode across Sydney. Thirty-five of the 234 postcodes have no public housing. Of the remaining 199, 162 (81%) have less than 10 per cent public housing. Only two postcodes have more than 40 per cent public housing. These are Waterloo (77%) and Claymore (88%). These statistics should be kept in mind when considering the results of this study. While we are concerned with the relationship between public housing, social factors and crime, the social factors and crime rates we are employing apply to the whole postcode, not just its public housing. With two exceptions, the majority of residents in the postcodes studied are not public housing tenants.

Figures from the DOH show that high-rise dwellings make up only 5.0 per cent of the public housing stock. The predominant types of public housing are walk-up style apartments as defined in Section 2.2.3 (39.8% of the total) and detached houses (36.3%). This contrasts with the overall picture of Sydney housing stock where 67.2 per cent of all occupied private dwellings are detached houses, and only 15.3 per cent are walk-up style apartments. Table 1 summarises these differences.

Table 1: Percentages of housing stock by type of dwelling

Dwelling type	Public housing dwellings ¹⁶	All occupied private dwellings ¹⁷
Detached	36.3	67.2
Non-detached	18.9	9.0
Walk-up	39.8	15.3
Other flats*	-	1.1
High-rise	5.0	7.4
TOTAL	100.0	100.0

* Includes flats attached to houses, shops etc.

3.2 PUBLIC RENTERS, PUBLIC HOUSING AND CRIME RATES

Table 2 presents the correlations between the offence rates, public renters and public housing. These correlations represent the relationship between the public housing factors and the offence rates in the absence of any other factors. The first number in each cell is the correlation coefficient, r . The second number is equal to $100r^2$ and can be interpreted as the percentage of the variation in the offence rate explained by the social factor. This number is included for ease of comparison with later results. All the correlations in Table 2 are statistically significant (at $\alpha = 0.05$).

Table 2: Correlations between offence rates and public housing factors

		Public renters	Public housing
Assault	r	0.62	0.60
	% of variation explained	37.9	36.0
Robbery	r	0.52	0.53
	% of variation explained	26.9	27.6
Malicious damage	r	0.56	0.55
	% of variation explained	31.8	30.8
Motor vehicle theft	r	0.50	0.49
	% of variation explained	24.7	24.2
Break and enter dwelling	r	0.44	0.43
	% of variation explained	19.3	18.1

There is very little difference between public renters and public housing in the offence rate correlations. All of the correlations are statistically significant. The strongest relationship appears to be with assault, where public renters and public housing account for 37.9 per cent and 36.0 per cent, respectively, of the variation in assault rates.

3.3 EFFECT OF PERCENTAGE OF PUBLIC RENTERS ON OFFENCE RATES

Table 3 presents the results for the statistical models developed for the five offence rates for Question 1. The first column in the table shows the percentage of variation in the offence rates across postcodes explained by the social factors associated with those postcodes (i.e. the base models). The second column shows the percentage of additional variation in offence rates explained when the percentage of public renters is added to each model. The third column shows the total percentage of offence rate variation explained when social factors and public renters are included in the models (i.e. the sum of the first two columns). All the results in Table 3 are statistically significant (at $\alpha = 0.05$).

Table 3: Percentage of public renters: percentages of variation in offence rates explained

	Variation explained by social factors	Additional variation explained by <i>public renters</i>	Variation explained by social factors plus <i>public renters</i> *
Assault	68.51	1.32	69.83
Robbery	56.59	3.25	59.84
Malicious damage	47.79	2.21	50.00
Motor vehicle theft	63.27	0.98	64.25
Break & enter dwelling	55.51	0.80	56.30

* Figures may not sum due to rounding errors

As Table 3 shows, the unique effect of public renters on each offence rate is small. The models developed from the social factors account for between 47.79 per cent (for malicious damage) and 68.51 per cent (for assault) of the variation. Adding the percentage of public renters into the models generates increases of between 0.80 per cent (break and enter dwelling) and 3.25 per cent (robbery).

3.4 EFFECT OF PERCENTAGE OF PUBLIC HOUSING ON OFFENCE RATES

The results of the statistical analyses for Question 2 are presented in Table 4. As in Table 3, column one shows the percentage of variation in offence rates explained by the base models (the data in column one are, of course, the same in both tables). The percentages of additional variation in offence rates explained when the percentage of public housing is added to the models are shown in column two. Column three shows the total percentage of offence rate variation explained when social factors and the percentage of public housing are included in the models. Again, all the results are statistically significant (at $\alpha = 0.05$).

Table 4: Percentage of public housing: percentages of variation in offence rates explained

	Variation explained by social factors	Additional variation explained by <i>public housing</i>	Variation explained by social factors plus <i>public housing</i> *
Assault	68.51	1.47	69.98
Robbery	56.59	3.16	59.75
Malicious damage	47.79	2.49	50.29
Motor vehicle theft	63.27	0.98	64.26
Break & enter dwelling	55.51	0.85	56.36

* Figures may not sum due to rounding errors

Table 4 shows that the effect of public housing is very similar to that of public renters. The proportion of variation in offence rates uniquely accounted for by public housing ranges from 0.85 per cent (break and enter dwelling) to 3.16 per cent (robbery).

Question 3 asked whether, if a relationship between crime rates and public housing were shown to exist, there was any particular level of public housing concentration where there was a sharp change in crime rates. The results of Questions 1 and 2 are such that, although there is a statistically significant effect, in practical terms the independent influence of the public housing factors on the offence rates is so small that Question 3 becomes meaningless.

3.5 PUBLIC HOUSING DISPERSAL AND OFFENCE RATES

To determine the effect of the dispersion of public housing (i.e. estates) throughout a postcode, two sets of statistical tests were conducted. Firstly, the estate factor was added to the base models in exactly the same way as public renters and public housing. No significant effect of estate was found for any of the offence rates. The second set of tests, in addition to controlling for social factors, also controlled for the percentage of public housing dwellings by including this factor in the models against which estate was tested. The base models for these tests are thus the inclusive models shown in the third column of Table 4. Table 5, below, shows the results of these tests.

Table 5: Public housing estates (controlling for percentage of public housing): percentages of variation in offence rates explained

	Variation explained by social factors plus <i>public housing</i>	Additional variation explained by <i>estate</i>
Assault	69.98	0.87
Robbery	59.75	0.72
Malicious damage	50.29	(0.72)
Motor vehicle theft	64.26	(0.40)
Break & enter dwelling	56.36	(0.06)

Results which are not statistically significant (at $\alpha = 0.05$) are shown in brackets. The estate factor only makes a statistically significant contribution to the explained variation in the cases of assault and robbery and, as can be seen from the table, the contributions are still very small.

3.6 PUBLIC HOUSING TYPE AND OFFENCE RATES

It makes little sense to consider dwelling type, as defined in Section 2.2.3, without first controlling for the amount of public housing in the postcode. For example, if all the public housing in a postcode is detached dwellings the value of the detached dwelling factor will be 100%, regardless of whether public housing makes up a large or a small proportion of the total number of dwellings in the postcode, and any distinction between high and low percentages of public housing will be lost. For this reason, type of dwelling factors are only considered in conjunction with the percentage of public housing in each postcode. This is achieved by including the percentage of public housing in the base models, as we did when testing for the effect of the estate variable. Each of the four dwelling type factors is then added separately to the base model to see whether it makes a significant contribution once the percentage of all public housing dwellings has been controlled for. Table 6 shows the base model for each offence type and the additional variation accounted for when each factor is separately added. Non-significant results are shown in brackets.

As Table 6 shows, none of the public housing types appears to exert much effect on crime rates. Detached dwellings as a percentage of public housing in a postcode appear to exert a relatively small albeit statistically significant effect on its robbery rate. Similarly, non-detached dwellings as a percentage of public housing in a postcode appear to exert a small but significant effect on its rates of assault, malicious damage to property and motor vehicle theft. Walk-up dwellings as a percentage of public housing in a postcode explain no statistically significant additional variation in any of the five crime rates. High-rise dwellings as a percentage of public housing in a postcode appear to exert a statistically significant effect on the rate of break and enter dwelling in a postcode.¹⁸

Table 6: Public housing types (controlling for percentage of public housing): percentages of variation in offence rates explained

	Variation explained by social factors plus <i>public housing</i>	Additional variation explained by <i>detached dwellings</i>	Additional variation explained by <i>non-detached dwellings</i>	Additional variation explained by <i>walk-up dwellings</i>	Additional variation explained by <i>high-rise dwellings</i>
Assault	69.98	(0.00)	1.04	(0.13)	(0.07)
Robbery	59.75	4.41	(0.41)	(0.13)	(0.17)
Malicious damage	50.29	(0.60)	2.39	(0.03)	(0.32)
Motor vehicle theft	64.26	(0.19)	0.91	(0.00)	(0.00)
Break & enter dwelling	56.36	(0.56)	(0.16)	(0.04)	0.76*

* Note: very skewed sample, result unreliable

4. INTERPRETATION OF RESULTS

The results of the present study provide little evidence to support the proposition that the quantity or type of public housing in a postcode exerts a strong effect on its recorded rates of assault, robbery, malicious damage to property, motor vehicle theft or break and enter dwelling, independently of social factors. Furthermore, as noted in Section 3.1, the data on crime rates and social factors describe the whole population of each postcode and not just the public housing tenants. With the exceptions of Claymore and Waterloo, public housing dwellings constitute less than half the dwellings in each postcode, and we should be very careful about ascribing the characteristics of the postcode's population as a whole to any particular group of individuals within that postcode. Even where statistically significant effects of public housing variables are obtained, they are generally small in magnitude. Moreover, the existence of a statistically significant relationship between a public housing variable and crime cannot be taken as proof that the variable in question exerts a causal influence on the crime rate. Some or all of the significant relationships obtained could reflect the result of inadequate controls. In other words, it may be that there are other unmeasured causes of offending which co-vary with the percentage of public housing.

The last point is particularly pertinent in interpreting the pattern of findings for public housing type shown in Table 6. It should not be assumed, for example, that the type of public housing exerts a causal effect on the rate of a particular offence just because the variable measuring that type of public housing exerts a statistically significant effect on the rate of that offence. The observation that the percentage of non-detached public dwellings influences the rate of vehicle theft, for example, may simply reflect the fact that areas with high proportions of non-detached dwellings (whether public or private) have fewer garages, thereby rendering vehicles more vulnerable to theft. Again, the observation that the percentage of detached dwellings exerts a statistically significant effect on the rate of robbery in a postcode may simply reflect the fact that areas with high proportions of detached public dwellings also happen, incidentally, to have a larger supply of attractive robbery targets.

It is not very surprising that once various factors indicative of social disadvantage have been controlled for, neither the type nor quantity of public housing appears to exert much effect on crime. As noted in the Introduction, there is a strong relationship between social disadvantage and crime. Since the 1981 Commonwealth-State Housing Agreement, priority housing allocation schemes have been developed to ensure that public housing goes first to those most in need. The social profile of those obtaining access to public housing therefore contains many of the features which increase both the risk of involvement in crime and the risk of criminal victimisation. Thus the effectiveness of agencies such as the DOH in targeting public housing has had the unintended effect of creating a statistical association between public housing and crime which many in the media and elsewhere have precipitously read as evidence of a causal connection.

Overall, it would seem that, looking at Sydney as a whole, the concentration of public housing into estates does not have a role in explaining crime rates over and above the actual percentage of public housing in each postcode. It may be that the number of concentrated public housing estates is too small to allow their effect to be detected. There may also be local effects of estates on unmeasured crime that the current methodology

is not capable of detecting. The best explanation, on current evidence, for high crime rates in areas with high proportions of public housing, however, remains the fact that public renters, being socially and economically disadvantaged, are therefore at more risk of becoming both crime victims and offenders.

Acknowledging all this, the present analysis should not be regarded as exhausting the potential for research into public housing and crime. There are two reasons for this. Firstly, even in the present analysis, postcodes were found which had comparable levels of public housing but quite different recorded crime rates. This raises the possibility that, at the margin at least, some features of public housing (other than its quantity) may be important determinants of crime. Secondly, recorded crime rates are often a crude measure of the kind of social disorder which generates anxiety about crime within neighbourhoods. This suggests that an analysis of the impact of public housing on residents' experiences of crime may yet reveal a role for public housing policy in reducing social disorder and public perceptions of crime.

NOTES

- 1 See, for example, Robert Samuels' (1995) report for the NSW Department of Housing on safety and security in the Warwick Farm area.
- 2 For an outline of such initiatives see NSW Department of Housing (1996a).
- 3 Named after a private development built at Radburn, New Jersey in 1927. See Jellicoe and Jellicoe (1987).
- 4 NSW Department of Housing 1995, Annual Report 1994/95, pp. 45 - 46: total expenditure of 624 million dollars plus total expenditure on capital works of 504 million dollars in the year ended 30 June 1995; NSW Police Service 1995, Annual Report, 1994/95, p. 99: total expenses of 1080 million dollars in the year ended 30 June 1995.
- 5 The statistic which represents correlation is called the correlation coefficient and is symbolised as r . The degree of association between factors is indicated by the value of r which may vary from plus one to minus one. A positive r value means that as one factor rises or falls so does the other, while a negative r indicates that as one rises the other falls. If r is one or minus one the correlation is said to be 'perfect', meaning that there is a one-to-one correspondence between the values of the factors.
- 6 The method used is multiple linear regression. See, for example, Tabachnick and Fidell (1989).
- 7 See Appendix 1 for details of the test statistic used to compare the models.
- 8 'Statistical significance': Statistical methods of the type used in the current study seek to test hypotheses about a situation. Frequently the hypothesis is of the form that the factor of interest has no effect on the situation being studied. The hypothesis being tested is referred to as the 'null' hypothesis. In the current study the null hypothesis is that public housing has no effect on crime rates once the effect of social factors has been taken into account. The procedure for testing the null hypothesis is as follows. One assumes that the null hypothesis is true and on that basis calculates the probability that the observed result could have arisen by chance. If this probability is very small, less than some pre-determined criterion value (usually $\alpha=0.05$ or $\alpha=0.01$), the null hypothesis is rejected and the result of the test is deemed to be 'statistically significant'. One may then conclude that the factor of interest does have a genuine effect. Statistical significance should not be confused with importance. It is quite possible to detect a statistically significant (i.e. genuine) effect which is, in practical terms, inconsequential.
- 9 Population sizes for each postcode have been taken from the ABS resident population estimates for 1994.
- 10 This is a finding supported by numerous studies. See for example Bottoms (1994) for a summary of some relevant research.
- 11 ABS, Basic Community Profile for NSW.
- 12 Definition provided by the Technical Policy Unit of the NSW Department of Housing in a personal communication.
- 13 'Turner Rigby' developments are generally buildings of two storeys with two or four dwellings, with the upper dwellings reached by means of an outside stairway.
- 14 Question 3 is dependent on the outcome of Questions 1 and 2, and is discussed in Section 3.4 in the light of these results.
- 15 The method of statistical analysis used in this study makes certain assumptions about the data. In some cases the factors included in the models have been mathematically transformed in order to meet these assumptions. Appendix 1 describes the transformations undertaken.
- 16 Source: DOH PRODATA database. Note that hostel type accommodation is excluded.
- 17 Source: ABS, Basic Community Profile for NSW (1991 Census). Note that caravans, houseboats and improvised dwellings are excluded.
- 18 This result should be treated with caution because one of the underlying assumptions of the analysis was compromised in conducting it.

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APPENDIX 1

NOTES ON METHOD

Data transformations

Multiple linear regression techniques are based on the assumption that the variables are normally distributed. However, a number of the variables ('factors') used in the analysis were not normally distributed. In such cases, Tabachnick and Fidell (1989) recommend mathematical transformation of non-normal data such as taking logs or square roots, and suggest trying a number of transformations in order to determine which is most effective (p. 84). The non-normal variables in the present study were transformed as follows:

The following variables were transformed by taking \log_{10} (one was added to each value in order to avoid errors in taking the log of zero values):

- robbery rate
- motor vehicle theft rate
- break and enter dwelling rate
- dwelling density
- public renters
- public housing
- young adult unemployment
- high-rise dwellings as a percentage of all public housing
- non-detached dwellings as a percentage of all public housing

The following variables were transformed by taking \log_{10} (as above) and then taking \log_{10} of the result (again adding one to avoid problems with zero values):

- assault rate
- malicious damage rate
- single-parent families
- unemployment
- Aboriginality

The following variable was transformed by taking the square root:

- detached dwellings as a percentage of all public housing

Extreme outliers

In multiple linear regression anomalous extreme scores may have a disproportionate influence on the analysis. Extreme outliers (postcodes) were thus excluded from the base models for each of the five crime rates using a Bonferroni correction, that is, changing the significance level to $0.05/234$ (i.e. the α rate divided by the number of cases) to determine the critical value of the Studentised residual. This resulted in the exclusion of

a maximum of six cases from each of the models. For discussion of the procedure, see, for example, Howell (1992), pp. 508 - 512.

Use of multiple regression in this study

The test statistic for comparing the two regression models, which is distributed as F, is computed using:

$$F = \frac{(ESS_a - ESS_b) / (b - a)}{ESS_b / (n - b - 1)}$$

Where:

- ESS_a is the residual sum of squares for the first regression model
- ESS_b is the residual sum of squares for the second (inclusive) regression model
- a is the number of independent variables in the first model
- b is the number of independent variables in the second model
- n is the number of cases

For full details see, for example, Snedecor G.W. and Cochran W.G. (1989) pp. 343-347.

APPENDIX 2

CORRELATIONS: SOCIAL FACTORS, OFFENCE RATES AND PUBLIC HOUSING FACTORS

Table 7: Correlations between offence rates and social factors*

		Assault	Robbery	Malicious damage	Motor vehicle theft	Break & enter dwelling
Low income						
	<i>r</i>	0.59	0.40	0.44	0.44	0.40
	% of variation explained	34.5	15.9	19.4	19.5	15.8
Unemployment						
	<i>r</i>	0.65	0.49	0.40	0.53	0.56
	% of variation explained	42.9	23.7	15.9	28.2	31.2
Young adult unemployment						
	<i>r</i>	0.50	0.56	0.35	0.55	0.48
	% of variation explained	25.2	31.5	12.4	30.1	23.3
Juveniles						
	<i>r</i>	-0.32	-0.31	-0.24	-0.44	-0.36
	% of variation explained	10.1	9.5	5.7	19.6	13.2
Single-parent families						
	<i>r</i>	0.59	0.56	0.54	0.52	0.46
	% of variation explained	35.1	31.9	29.3	27.3	21.2
Stability						
	<i>r</i>	-0.41	-0.22	-0.37	-0.41	-0.45
	% of variation explained	16.6	4.9	13.5	16.7	20.1
Aboriginality						
	<i>r</i>	0.53	(0.04)	0.41	0.28	0.19
	% of variation explained	28.2	(0.1)	17.2	8.1	3.6
Dwelling density						
	<i>r</i>	0.38	0.62	0.31	0.51	0.48
	% of variation explained	14.6	38.1	9.5	26.1	23.4
Non-qualification						
	<i>r</i>	0.28	(0.04)	(0.04)	(0.09)	(0.05)
	% of variation explained	8.0	(0.1)	(0.2)	(0.7)	(0.2)

*All correlations are for the transformed variables (see Appendix 1). Non-significant correlations are shown in brackets.

Table 8: Correlations between social factors and public housing factors*

		Publicrenters	Public housing
Low income			
	<i>r</i>	0.55	0.56
	% of variation explained	30.6	31.5
Unemployment			
	<i>r</i>	0.58	0.55
	% of variation explained	33.2	30.7
Young adult unemployment			
	<i>r</i>	0.57	0.55
	% of variation explained	32.3	29.9
Juveniles			
	<i>r</i>	(-0.05)	(-0.06)
	% of variation explained	(0.2)	(0.4)
Single-parent families			
	<i>r</i>	0.65	0.64
	% of variation explained	41.9	40.4
Stability			
	<i>r</i>	-0.20	-0.15
	% of variation explained	3.8	2.4
Aboriginality			
	<i>r</i>	0.47	0.43
	% of variation explained	21.8	18.6
Dwelling density			
	<i>r</i>	0.29	0.31
	% of variation explained	8.2	9.6
Non-qualification			
	<i>r</i>	0.42	0.40
	% of variation explained	17.4	16.4

*All correlations are for the transformed variables (see Appendix 1). Non-significant correlations are shown in brackets.